REMARKS/ARGUMENTS

Re-examination and favorable reconsideration in light of the above amendments and the following comments are respectfully requested.

Claims 1 – 4, 7 – 12, 14 – 21, 23 – 29, 31 – 35, and 37 – 51 are pending in the application. Currently, no claim stands allowed.

By the present amendment, claims 25, 37 - 39 and 46 have been amended and claim 32 has been cancelled.

In the office action dated April 28, 2003, claims 1 – 3 and 37 – 40 were rejected under 35 U.S.C. 102(b) as being anticipated by the Lupfer patent of record; claims 1 – 4 and 51 were rejected under 35 U.S.C. 102(b) as being anticipated by the Arai '472 patent of record; claims 1 – 4, 7 – 18, 20 – 28, 31 – 35 and 51 were rejected under 35 U.S.C. 102(b) as being anticipated by the Arai '235 patent of record; claims 7 – 12, 14 – 18, 20, 21, 23 – 28, 31 – 35, 37 – 41, 46, 47, 50, and 51 were rejected under 35 U.S.C. 102(b) as being anticipated by the Harada patent publication of record; claims 7 – 12, 14 – 18, 20, 21, 23 – 28, 31 – 35, 37 – 41, 46, 47, 50, and 51 were rejected under 35 U.S.C. 102(e) as being anticipated by the Nishimura patent of record; and claims 1 – 4, 7 – 12, 14 – 21, 23 – 29, 31 – 35, 37 – 51 were rejected under 35 U.S.C. 103(a) as being unpatentable over Brinkmann in view of Applicant's alleged disclosure of prior art.

The foregoing rejections are traversed by the instant response.

The present invention relates to a coating to be applied to an electrically conductive material. The coating is non-electroplated and consists of more than 1.0 wt% to about 20 wt% silver and the balance tin in one embodiment. The coating has a melting point greater than 225 degrees Centigrade and a hardness in the range of from 0.32 to 0.41 GPa.

The present invention also relates to a coating consisting of more than 1.0 wt% to 20 wt% silver, at least one addition selected from the group consisting of bismuth, silicon, copper, magnesium, iron, manganese, zinc, and antimony in an amount effective to increase coating hardness up to 5.0 wt%, and the balance tin. The coating material being non-electroplated and having a hardness in the range of from 0.32 GPa to 0.41 GPa.

The process for forming coating a substrate material in accordance with the present invention comprises the steps of providing a substrate material to be coated, preparing a bath consisting of more than 1.0 wt% to about 20 wt% silver and the balance tin, immersing the

substrate material in the bath to form a coating layer on the substrate material, which coating layer consists of more than 1.0 wt% to about 20 wt% silver, and maintaining the bath at a temperature greater than 500 degrees Fahrenheit during the immersing step. The process further comprises keeping the substrate material resident in the bath for a time period in the range of from 0.2 seconds to 10 seconds.

The Examiner is thanked for the courtesy of conducting a personal interview with the inventor and the undersigned attorney on June 17, 2003. During the interview, each of the rejections of record were discussed in detail. While no agreement was reached at the interview about the allowance of the instant application, the interview was quite helpful in preparing this response.

With regard to the rejection of claims 1 – 3 and 37 – 40 over Lupfer, it is submitted that these claims are allowable for the following reasons. Lupfer relates to a dip soldering technique wherein the dip solder is formed from binary tin-silver compositions which may include 2 wt% to 10 wt% silver. As indicated in Applicant's previous response, Lupfer does not teach or suggest a coating having the claimed hardness. As previously stated, this is because solders have much lower hardnesses than coatings formed using the present invention. For example, a 95% tin – 5% silver coating formed in connection with the present invention will have a hardness of 0.36 GPa, while a 95% tin – 5% silver solder will have a hardness of 0.032 GPa – an order of magnitude lower. The same holds true for a 90% tin – 10% silver coating vs. a 90% tin – 10% silver solder and a 98% tin – 2% silver coating vs. a 98% tin – 2% silver solder. This is confirmed by the attached Declaration of Richard W. Strobel. Thus, the Examiner is in error when he says that hardness is inherent to the composition. Hardness is a function of processing as well as composition.

As for claims 37 – 40, these claims are allowable because Lupfer fails to teach or suggest forming a coating having the claimed composition and hardness and the claimed temperature maintaining step set forth in independent claim 39.

With respect to the rejection of claims 1 – 4 and 51 over Arai '472, this rejection fails because Arai '472's coating is an electroplated coating and both claim 1 and claim 51 call for the coating to be non-electroplated. As discussed during the interview and as pointed out in paragraph 5 of the Strobel declaration, an electroplated coating is very much different physically

than a non-electroplated coating. Thus, there is meaning to the term "non-electroplated" – meaning which should be accorded patentable weight. Further, there is no disclosure in Arai '472 of the coating having a hardness in the range of from 0.32 to 0.41 GPa. While the Examiner has taken the position that the hardness is inherent in the composition, there is no evidence to support such a position. In fact, the evidence produced by Applicant with respect to the Lupfer coating and the Brinkmann coating clearly shows that such a position is erroneous. Further, electroplated coatings are characterized by undercuts, which make them very brittle. A problem not encountered with the coatings of the present invention. For these reasons, claims 1 – 4 and 51 are allowable over Arai '472.

With regard to the rejection of claims 1 – 4, 7 – 18, 20 – 28, 31 – 35 and 51 over Arai '235, these claims are allowable for the same reasons that the claims are allowable over Arai '472. Arai '235 is directed to the formation of an electroplated coating, not a non-electroplated coating. Very significantly, electroplated coatings are characterized by undercuts, which make them very brittle. Further, Arai '235 does not disclose that the coatings formed using his electroplating solution have the claimed hardness. For these reasons, claims 1 – 4, 7 – 18, 20 – 28, 31 – 35 and 51 are allowable over Arai '235.

With respect to the rejection of claims 7 – 12, 14 – 18, 20, 21, 23 – 28, 31 – 35, 37 – 41, 46, 47, 50, and 51 over Harada, Applicant again points out that Harada relates to a tin-silver-copper alloy soldered wire with a hot dip soldering or plating layer composed of 0.5 to 20% silver, 0.01 to 2.0% copper, and the balance tin. The plating layer is very thin (1 – 10 microns). The soldered wire is joined to a through hole in a printed circuit board by a brazing filler metal. The soldered wire is soldered with a copper-applied layer in the substrate. The tin-copper-silver plating layer is melted so that the silver and tin disperse and elute into the brazing filler metal. The silver in the plating layer is spread into the brazing filler metal of the joint part, while the tin in the plating layer is eluted into the brazing filler metal of the joint part. It is submitted that the Harada patent is directed to subject matter vastly different from that being claimed here. In particular, Harada is not looking at applying a coating to a substrate which coating must have certain hardness properties for its intended purpose. As described above, Harada applies a plating layer which is designed to have the tin and silver elute and disperse respectively into a brazing filler metal. The claims as presented herein are allowable over Harada because there is

no teaching or suggestion of the hardness set forth in claims 7, 15, and 25, the bath composition of claim 39, the formation of a coating having the composition and the hardness set forth in claim 39 and/or the bath temperature maintaining step of claims 39 and 46. In Harada, the bath is maintained at a temperature less than 500 degrees Fahrenheit (see paragraph [0012] of Harada). Harada does not teach or suggest maintaining the bath at a temperature greater than 500 degrees Fahrenheit. As previously discussed, hardness is not solely a function of composition. It is also a function of the processing. In Harada, hardness is a non-issue because of what happens to the plating layer in its ultimate use. Thus, it can not be said that Harada in any way would teach or suggest the claimed hardness.

With respect to the rejection of claims 7 – 12, 14 – 18, 20, 21, 23 – 28, 31 – 35, 37 – 41, 46, 47, 50, and 51 over Nishimura, it is submitted that Nishimura does not teach or suggest the subject matter of independent claims 7, 15, 25, 39, 46, and 51. This patent relates to the use of a molten solder bath containing tin, *nickel*, and copper as the major constituents thereof. In one embodiment, the solder bath also contains about 3.5% silver. The patent publication is entirely silent as to the nature of any solder which is used to join two parts together and the physical properties. Nishimura does not anticipate claim 7, or its dependent claims, because claim 7 as written uses the term "consisting of" and thereby excludes nickel. Further, Nishimura does not teach or suggest the hardness limitation of claim 7. Independent claims 15, 25, and 51, and the claims which depend from them, are allowable for the same reasons. With regard to independent claims 39 and 46, and the claims which depend from them, Nishimura does not teach or suggest the bath composition in either claim 39 or 46 – again, because nickel has been excluded. With respect to claim 39, Nishimura also fails to teach or suggest the formation of the claimed binary tin silver coating.

With respect to the rejection of claims 1 – 4, 7 – 12, 14 – 21, 23 – 29, 31 -35, and 37 – 51 on obviousness grounds over Brinkmann et al. in view of Applicant's disclosure of the prior art, the rejection is defective on its face. Other than mentioning the subject matter of claims 19 and 29, the Examiner has not explained how Applicant's alleged disclosure of the prior art teaches or suggests any aspect of the subject matter of the other rejected claims. Nor has the Examiner explained why one would be motivated to combine the teachings of Brinkmann et al. and the

alleged disclosure of prior art to reach the subject matter of claims 1 – 4, 7 – 12, 14 – 18, 20, 21, 23 – 28, 31 – 35, and 37 – 51.

With regard to Brinkmann et al., this patent relates to an electrical connector pair with a male plug being given a tin alloy coating. The tin alloy coating may contain lead, as well as small amounts of deoxidization and processing additives and up to 10% by weight of at least one element selected from the group consisting of silver, aluminum, silicon, copper, magnesium, iron, nickel, manganese, zinc, zirconium, antimony, rhodium, palladium, and platinum. On its surface, it would appear that Brinkmann et al. teach a binary tin-silver alloy; however, they do not. There is absolutely nothing in this reference which would teach one of ordinary skill in the art to select silver from the laundry list of possible candidates to form a binary tin-silver system. In fact, if one looks at the examples in Brinkmann, the tin-silver alloy systems used by Brinkmann contain 4.0% or less silver *in combination with* phosphorous and/or other constituents. See claim 4 of the Brinkmann et al. patent. The addition of phosphorous is quite significant. Its purpose is to act as a deoxidizing agent – phosphorous is a know deoxidizing agent. While the Examiner has stated that phosphorous has been added at an impurity level, this is not true. Phosphorous has been intentionally added at a level sufficient to accomplish its role as a deoxidizing agent. Phosphorous has a deleterious effect on both hardness and electrical conductivity. To demonstrate the effect of the phosphorous on hardness, Applicant had a test conducted at MIT using a sample with the same composition as the material described in Example 1 of Brinkmann et al. The test and the test results are reported in the attached Strobel declaration. The test clearly showed that the material containing the phosphorous had a significantly lower hardness than a material containing 98% tin – 2% silver, 95% tin – 5% silver, 90% tin – 10% silver. The hardness was even lower than 100% tin. In fact, the hardness is lower than the hardness range set forth in Applicant's article claims and in process claim 39. With regard to electrical conductivity, the phosphorous has a negative impact. This is also set forth in the Strobel declaration. In general, Brinkmann et al do not enable one to form the claimed coating compositions with the claimed hardness. To form the compositions with the claimed hardness, one would have to select the right constituents and process them in an appropriate manner. Brinkmann et al. offer no guidance as to how to do this. Consequently, it is submitted that Brinkmann et al. in no way teaches or suggests the subject matter of independent

claims 1, 7, 15, 25, 39, and 51 for the foregoing reasons. Claims 2 – 4, 8 – 12, 14, 16 – 18, 20, 21, 23 -28, 31, and 33 – 35 are allowable for the same reasons as well as on their own accord. Claims 19 and 29 are allowable for the same reasons as their parent claims, as well as there is no teaching or suggestion of applying the claimed coatings to a copper-tellurium substrate.

With regard to the process claims, there is no teaching or suggestion in Brinkmann et al. of forming the binary bath compositions set forth in claims 37 – 39. There is also no teaching or suggestion in Brinkmann et al. of forming the bath composition set forth in claim 46. For example, one of the materials which Brinkmann et al. list in the laundry list is nickel. There is nothing which would teach or suggest omitting nickel. In fact, the bath used to form the alloy composition of Brinkmann et al.'s example 2 includes nickel. Still further, there is a clear suggestion in Brinkmann et al. that whenever one is going to use silver in the bath, one must also add phosphorous. Still further with respect to claim 46, there is nothing in Brinkmann et al. which teaches or suggests the residence time which is significant in the formation of a coating having the claimed hardness. For these reasons, claims 37 – 50 are allowable over Brinkmann et al.

For the foregoing reasons, the instant application is believed to be in condition for allowance. Such allowance is respectfully solicited.

Should the Examiner believe that an additional amendment is needed to place the case in condition for allowance, he is invited to contact Applicant's attorney at the telephone number listed below.

A request for a one month extension of time is appended hereto along with a check in the amount of $55.00 to cover the cost of the extension of time. Should the Commissioner

determine that an additional fee is due, he is hereby authorized to charge said fee to Deposit Account No. 02-0184.

Respectfully submitted,

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By _____

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Date: August 22, 2003

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313" on August 22, 2003.

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Nicole Motzer